FE-BASE BUILD-UP ALLOY EXCELLENT IN RESISTANCE TO CORROSION AND WEAR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an Fe-base build-up alloy excellent in resistance to corrosion and wear, which permits, when applying surface hardening build-up welding by TIG or PTA to a friction part such as a valve or a valve seat used in a chemical plant, particularly in a nuclear power plant, formation of weld beads having a very high hardness and excellent in resistance to corrosion as well as to wear in high-temperature and high-pressure water.

2. Prior Art

A Co-base alloy (Co-28Cr-4W) is employed for surface hardening build-up of valves and valve seats used in chemical and nuclear power plants for its excellent resistance to wear and corrosion.

However, because accumulation of radioactive corrosion products in various chemical plants, particularly in nuclear power plants leads to an increased quantity of radiation, the necessity of reducing Co^{60} is recognized to inhibit it, and there is an increasing demand for using Co-free Ni or Fe-base alloys from the point of view of improving safety. While various alloys have been proposed, there is available at present no alloy provided with all the necessary properties such as corrosion resistance and wear resistance. It is therefore still inevitable to use the Co-base alloy involving safety problems.

SUMMARY OF THE INVENTION

From the aforementioned point of view the present inventors carried out studies with a view to developing a material suitable for surface hardening build-up of a friction part such as a valve or a valve seat used in a nuclear power plant or the like, and found as a result that an Fe-base alloy containing in weight percent:

C: from 0.005 to 1.6%,
Mn: from 4 to 28%,
Cr: from 12 to 36%,
Mo: from 0.01 to 9%,
Hf: from 0.005 to 15%, and
N: from 0.01 to 0.9%,

and containing, depending on the results desired:

Si: from 0 to 5% and
Ni: from 0 to 30% or
Si: from 0.01 to 5%, and
Ni: from 5 to 30%,

and further additionally containing, depending on the results desired one or both of:

Nb: from 0 to 6% and
W: from 0 to 6% or
Nb: from 0.01 to 6%, and
W: from 0.01 to 6%, and

the balance being Fe and incidental impurities has a Vickers hardness of over 420 at the ambient temperature, is excellent in corrosion resistance and intermetallic wear resistance in hot water at 300° C., applicable for build-up welding and casting, and would therefore display its full merits for a very long period of time when employed in valves or valve seats used in a severe environment involving corrosion and wear as in a nuclear power plant or a chemical plant.

DETAILED DESCRIPTION OF THE INVENTION

The present invention is based on the above-mentioned finding. The reasons of limiting the chemical composition as above are described below.

(a) C

The C component has effects of improving strength through dissolution into the matrix, improving hardness (wear resistance) through formation of M_7C_3, MC and $M_{23}C_6$ type carbides by the combination with such alloy elements as Cr, W, Nb, Hf and Mo, and furthermore improving weldability and castability. However, with a carbon content of under 0.005%, desired effects as described above cannot be achieved. A carbon content of over 1.6%, on the other hand, not only causes precipitation of more carbides, but also leads to larger particles sizes of carbides, resulting in a lower toughness. The C content should therefore be within the range of from 0.005 to 1.6%.

(b) Mn

The Mn component has an effect of stabilizing austenite through dissolution into the matrix and deoxidizing and desulfurizing effects, and particularly has an effect of improving wear resistance (hardness) and corrosion resistance. With an Mn content of under 4%, however, desired effects as described above are not available. An Mn content of over 28%, on the other hand, not only brings about no further improvement in the effects as described above, but also makes it difficult to accomplish melting and casting of alloy. The Mn content should therefore be within the range of from 4 to 28%.

(c) Cr

The Cr component has effects of particularly improving hardness through dissolution of part thereof into the matrix and formation of carbides from the remaining part, thereby improving wear resistance, and in addition, of improving corrosion resistance in hog water. If the Cr content is under 12%, however, desired effects as described above cannot be obtained. With a Cr content of over 36%, on the other hand, toughness tends to decrease. The Cr content should therefore be within the range of from 12 to 36%.

(d) Mo

The Mo component has an effect of improving hardness (wear resistance) and strength through dissolution into the matrix. However, an Mo content of under 0.01% cannot give a desired effect as described above, and an Mo content of over 9% causes decrease in toughness as in the case of the W component, thus resulting in a lower impact resistance. The Mo content should therefore be within the range of from 0.01 to 9%.

(e) Hf

The Hf component has effects of improving corrosion resistance through dissolution into austenitic matrix formed mainly by the Fe, Ni and Cr components, and improving hardness through formation of MC-type carbides by the combination with C. However, an Hf content of under 0.005% cannot give desired effects as described above, and an Hf content of over 15% brings about no further improving effects and is economically